University of Technology, Sydney

Development of a Lean Six Sigma Implementation Framework for Small and Medium Sized Indonesian Manufacturing Enterprises

By

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Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated and referenced in the thesis.

Signature of Candidate

I dedicate this thesis to my beloved parents:

Fatmah Ashiblie and Khalid Amar

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Amar, K. & Davis, D. (2007), "Evaluating Six Sigma in the Indonesian SME Context", published in the Proceedings of the 5th ANZAM and 1st Asian Pacific Operations Management Symposium, 6-7 June, Melbourne.

Amar, K. & Davis, D. (2008), "A Review of Six Sigma Implementation Frameworks and Related Literature", published in the Proceedings of the IAENG: International Conference on Industrial Engineering, 19-21 March, Hong Kong.

Amar, K. & Davis, D. (2008), "Are Indonesian SMEs Prepared for Lean Six Sigma?", published in the Proceedings of the 13th International Conference on ISO 9000 and TQM, 24-26 March, Kuala Lumpur.

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Glossary

ABS	Australian Bureau of Statistics
ASEAN	Association of South East Asian Nations
BDS	Business Development Services
BPR	Business Process Re-engineering
BPS	Central Bureau of Statistics
BSN	National Standardization Agency of Indonesia
CSF	Critical Success Factors
CTQ	Critical to Quality
DMAIC	Define-Measure-Analyse-Improve-Control
DOE	Design of Experiments
FAZAT	Research and Training Center for Labour and Technology Steyr
FFF	Austrian Industrial Research Promotion Fund
Five S (5S)	Seiri, Seiton, Seiso, Seiketsu, Shitsuke
FMEA	Failure Mode and Effect Analysis
GB	Green Belt
IDB	Islamic Development Bank
IFC	International Finance Corporation
IPO	Input-Process-Output
ISO 9000	International Standards Organisation
IT	Information Technology
JICA	Japan International Cooperation Agency
JIT	Just In Time
LIK-UPT	Centre for Small Industry
LSS	Lean Six Sigma
MBB	Master Black Belt
MBNQA	Malcolm Baldrige National Quality Award
MITI	Ministry of Industry and Trade of Japan
MSA	Measurement System Evaluation

NIES	National Industry Extension Service
P3ED	Regional Export Training and Promotion Center
PPM	Part per Million
PUPUK	Association for the Advancement of Small Business
QCC	Quality Control Circle
QM	Quality Management
ROA	Return on Assets
ROE	Return on Equity
SCM	Supply Chain Management
SIPOC	Supplier-Inputs-Process-Outputs-Customers
SME	Small and Medium Enterprise
SMED	Single Minute Exchange of Dies
SMIs	Small and Medium Industries
SENADA	Indonesia Competitiveness Program
SNI	Standard National of Indonesia
SPC	Statistical Process Control
SQC	Statistical Quality Control
STM	Vocational High School
STEP	Shell Technology Enterprise Programme
SWP	Software Park Hagenberg
TPM	Total Productive Maintenance
TQM	Total Quality Management
UIN	Universitas Islam Negeri
UTS	University of Technology, Sydney
VIF	Variance Inflation Factors

Abstract

The main objective of this research was to develop an implementation framework for the introduction of the Lean Six Sigma improvement approach into small and medium enterprises (SMEs) in Indonesia. It was expected that an appropriate diffusion of Lean Six Sigma would assist the SMEs to improve their competitiveness.

The research involved a close examination of Indonesian SMEs and their support networks in order to evaluate the suitability of the Lean Six Sigma approach and to inform the design of an effective implementation framework.

Six Sigma is a popular business improvement approach. In Lean Six Sigma ideas from Lean Production (Womack, Jones and Ross 1984) have been incorporated with Six Sigma. There is some evidence that Lean Six Sigma has advantages over Six Sigma and provides a strengthened business improvement approach.

Rogers' diffusion of innovations theory is used as the theoretical framework for the research (Rogers 2003). The theory is particularly useful in guiding the diffusion of an innovation developed in one cultural setting into a different cultural setting.

The literature review covers the history and development of Six Sigma and Lean Six Sigma. Also, related approaches such as TQM and ISO 9000 are reviewed. A number of existing Six Sigma implementation frameworks were found in the literature and reviewed.

A review of Rogers' diffusion of innovations theory was undertaken. Also research identifying critical success factors (CSFs) associated with the implementation of improvement approaches such as TQM was undertaken. Rogers' theory and the CSFs literature were important inputs in the research methodology.

Literature on SMEs in general and Indonesian SMEs in particular was reviewed. The contribution of SMEs to the Indonesian economy, the various forms of support available to them and the stage of development of improvement programs was reviewed.

The majority of data were collected through the development and administration of a questionnaire survey completed by SME owners/managers. A sample of 148 usable questionnaires was obtained. Interviews were also conducted with SME owners/managers and other stakeholders e.g., government, Business Development Services (BDS), universities, customers and suppliers.

The results showed that SMEs had a relatively low usage of improvement tools and Information Technology (IT). This low technical base presents a challenge to the successful implementation of Lean Six Sigma. However, owners/managers were relatively optimistic about the success of such an innovation and reported encouraging levels of commitment both by themselves and their employees for such change.

The results established that SME owners/managers were most influenced by their key customers and other SMEs when making decisions about adopting an innovation. The results indicated a preference for face-to-face rather than virtual (online) training. Areas for improvement in the support provided to SMEs from government were reported.

The main outcome of this research is an implementation framework of Lean Six Sigma for SMEs. The frameworks' elements are owner/manager commitment and involvement, training, employee involvement, culture change and external support. The framework is designed specifically for the Indonesian SMEs context and includes the element 'external support' which is not present in any of the existing frameworks that were reviewed.